CLAIMS

We claim:

1. A method of steam reforming, comprising:

passing steam and hydrocarbon through a reaction chamber;

wherein the reaction chamber comprises a catalyst that has surface active sites comprising a material selected from the group consisting of rhodium, iridium, nickel, palladium, platinum, ruthenium, carbide of group VIb and combinations thereof;

wherein the rate of said passing steam and hydrocarbon is controlled such that residence time in the reaction chamber is less than about 0.1 seconds;

wherein, after passing through the reaction chamber, the hydrocarbon conversion has reached at least 50% of equilibrium conversion.

2. The method of claim 1 wherein the reaction chamber comprises a catalyst that has surface active sites comprising a material selected from the group consisting of rhodium, iridium, nickel, palladium, platinum, and combinations thereof; and

wherein at least 50% of said hydrocarbon has been converted to products after passing through the reaction chamber.

3. The method of claim 2 wherein the temperature in the reaction chamber is in the range of 500 °C to 1000 °C;

4. The method of claim 2 wherein the catalyst comprises a spinel support.

5. The method of claim 1 wherein the catalyst comprises a zirconia support.

6. The method of claim 3 wherein the catalyst comprises:

a first porous structure with a first pore surface area and a first pore size of at least 0.1 μm; and

a porous interfacial layer with a second pore surface area and a second pore size that is less than the first pore size.

7. The method of claim 6 wherein the porous interfacial layer comprises a spinel.

8. The method of claim 6 wherein the first porous structure comprises a metal foam or metal felt, and the porous interfacial layer comprises alumina.

9. The method of claim 1 wherein the catalyst has a pore volume of 30 to 95% and at least 50% of the catalyst's pore volume is composed of pores in the size range of 0.3 to 200 microns.

10. The method of claim 3 wherein the hydrocarbon is converted to at least 90% of equilibrium conversion and hydrogen selectivity is at least 85%.

11. The method of claim 10 wherein the catalyst comprises surface active sites comprising Rh.

12. A method of steam reforming, comprising:

passing steam and hydrocarbon through a reaction chamber;

wherein the reaction chamber comprises a catalyst;

wherein the catalyst comprises:

a first porous structure with a first pore surface area and a first pore size of at least 0.1 μm;

a porous interfacial layer with a second pore surface area and a second pore size that is less than the first pore size; and

a catalyst metal.

13. The method of claim 12 wherein the rate of said passing steam and hydrocarbon is controlled such that residence time in the reaction chamber is less than about 0.1 seconds;

wherein at least 50% of said hydrocarbon has been converted to products after passing through the reaction chamber.

14. The method of claim 13 wherein the catalyst that has surface active sites comprising a material selected from the group consisting of rhodium, iridium, nickel, palladium, platinum, and combinations thereof.

15. The method of claim 13 wherein the porous interfacial layer comprises a material selected from the group consisting of alumina, spinel and zirconia.

16. A method of steam reforming, comprising:

passing steam and hydrocarbon through a reaction chamber;

wherein the reaction chamber comprises a catalyst;

wherein the catalyst comprises:

catalyst has a pore volume of 30 to 95% and at least 50% of the catalyst's pore volume is composed of pores in the size range of 0.3 to 200 microns; and

a catalyst metal.

17. The method of claim 12 wherein the rate of said passing steam and hydrocarbon is controlled such that contact time in the reaction chamber is in the range of 5 to 100 milliseconds; and

wherein, after passing through the reaction chamber, the hydrocarbon conversion has reached at least 50% of equilibrium conversion.

18. The method of claim 16 wherein the catalyst has a hydrogen productivity of at least 0.7 $mmol \cdot s^{-1} \cdot cm^{-3}$.

19. The method of claim 11 having a hydrogen productivity of between 0.5 and 2 $mmol \cdot s^{-1} \cdot cm^{-3}$ at a contact time of 10 to 25 msec.

20. The method of claim 11 wherein the hydrocarbon comprises a synthetic fuel made by the Fischer-Tropsch process and wherein, after passing through the

reaction chamber, the hydrocarbon conversion has reached at least 70% of equilibrium conversion.